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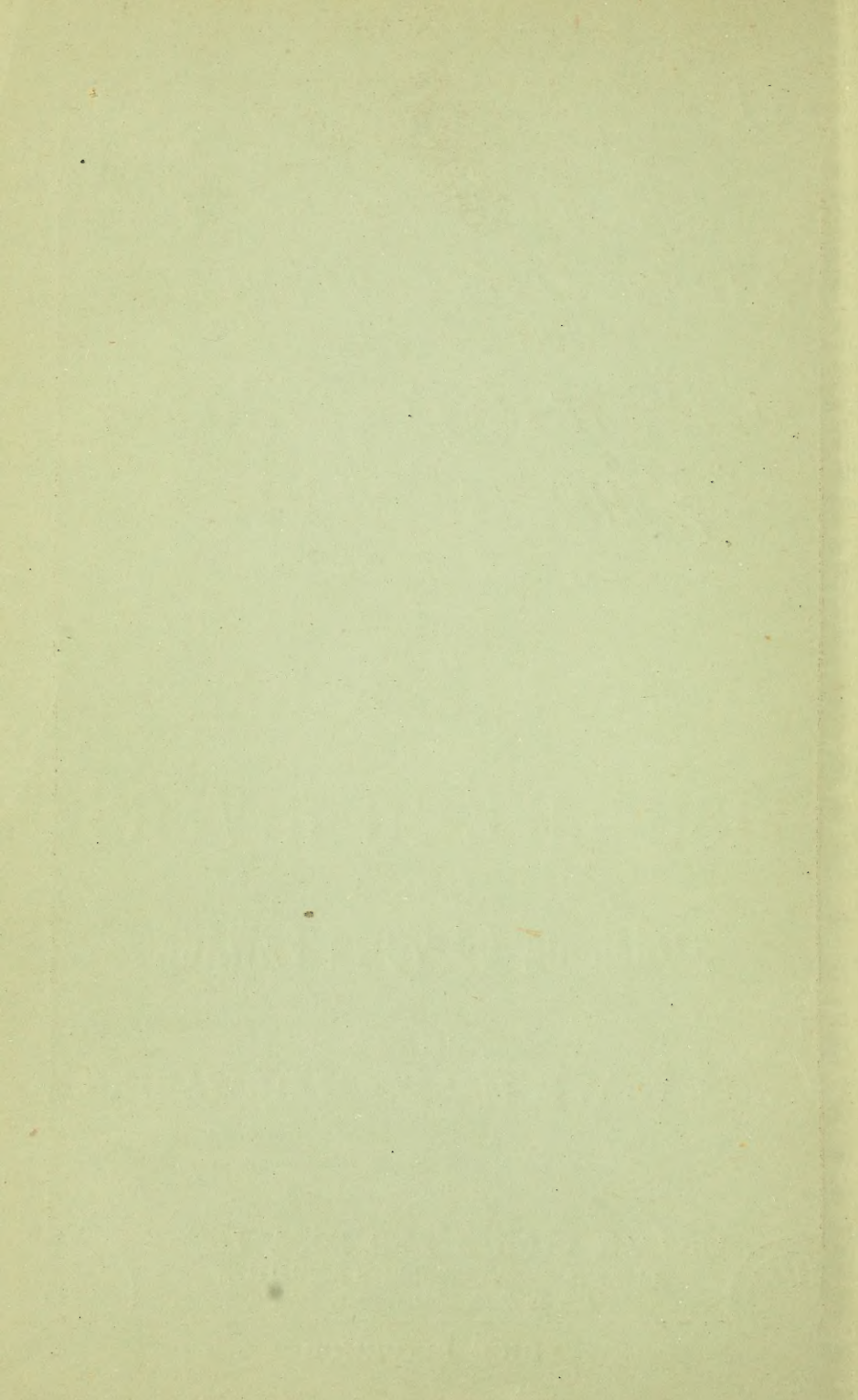
*PAPERS OF THE CONFERENCES*  
*Held in connection with*  
*The GREAT INTERNATIONAL*  
*FISHERIES EXHIBITION*

THE  
PRESERVATION  
OF  
FISH LIFE IN RIVERS  
BY THE  
EXCLUSION OF TOWN SEWAGE

BY  
HON. W. F. B. MASSEY MAINWARING

LONDON  
WILLIAM CLOWES AND SONS, LIMITED  
INTERNATIONAL FISHERIES EXHIBITION  
AND 13 CHARING CROSS, S.W.

PRICE SIXPENCE



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# *International Fisheries Exhibition*

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CONFERENCE ON MONDAY, 16TH JULY, 1883.

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## PRESERVATION OF FISH LIFE IN RIVERS BY EXCLUSION OF TOWN SEWAGE.

The Chair was taken by FRANCIS GOULD, Esq., in the absence of the Marquis of Hamilton, who had sent a letter saying he was compelled to leave town. The Chairman said he was much interested in this question; and had only recently attended a meeting on the same subject, which was one intimately connected with the work proposed to be done by this splendid Exhibition. Mr. Mainwaring was the Chairman of the Aylesbury Native Guano Co., whose works he had several times had the pleasure of visiting, and as a member of the Thames Valley Joint Sewerage Board, he was aware of the work on which the Board had been engaged for many years at vast expense, in endeavouring to free the Thames from its pollution. He hoped they would succeed in doing so ere long, and he was quite sure that if ever it were done, it would be by working in the same direction as the Aylesbury Company. They had tried irrigation and diversion, but the Board had come unanimously to the conclusion to try chemical treatment. The importance of this question was palpable to every one who had considered it, and he hoped when this paper had been read it would be still more palpable to the public at large.

The Hon. W. F. B. MASSEY MAINWARING spoke as follows :

It may occur to some present here to-day that I ought to give some reason for appearing before you to read the Paper with which my name is connected. The only excuse I can give for asking your attention for my feeble effort is, that when the Norwich Fisheries Exhibition was in embryo, I suggested that one of its classes should be devoted to exhibits for the best means of rendering our rivers and streams free from the pollution of town sewage.

A large number of scientific gentlemen, among others him whose name was, and is still, I believe, a household word among every assembly of men interested in our fisheries, I mean the lamented Frank Buckland, have held that one of the causes of the fish epidemic that is rapidly depopulating the finny tribe in our streams, had its origin in the dangerous germs produced by the putrid and excrementitious matter allowed to enter in large quantities into our rivers and streams, and I was, therefore, very anxious to prove that if there were any remedies existing, they ought to be more widely known through the medium of a public exhibition. I am well aware that I shall be met by this remark : "You are about to tell us of remedies to be applied ; but first prove that our rivers and streams are in a sickly and unhealthy condition before you propose a prescription that may be entirely unnecessary ; and even admitted that the waters are in this insalubrious condition, are they dangerous and antagonistic to fish life as well as human life ?" Both these propositions are, I regret to say, fiercely contested. It might seem nearly ridiculous for me to take up your time by endeavouring to prove the pollution of some of our waterways, if it were not that at this

moment a Royal Commission is sitting in solemn conclave to determine whether our metropolitan river is "a limpid translucent crystal stream," or in the same condition as—

"The river Rhine it is well known,  
Doth wash your City of Cologne;  
But, tell me, nymphs, what power divine  
Shall henceforth wash the river Rhine?"

But the subtle advocates of the purity of Father Thames and many other rivers, I dare say, will tell us, "Oh, we know they are polluted; but they are not dangerously impure!" I ask these said gentlemen the following questions: Are we to await some fearful epidemic to bring us to our senses, which would indeed force the responsible authorities, at the point of the bayonet, to cease polluting our waters? Are we to wait until the obdurate nasal organs of these doubting officials can count—

". . . two and seventy stenchs,  
All well defined and several stinks?"

or, are we to take the preliminary warning that the Almighty seems to me to be giving us? When waters cease to be a healthful natural element for the salmon and trout, they surely must have in their composition some impurities that are dangerous to the thousands of human beings, and also the herds of cattle that slake their thirst from these once limpid, but now polluted waters.

Two frightful catastrophes have lately taken place, and the hearts of Englishmen have bled for the childless ones of Sunderland, and the widows and fatherless of Glasgow; surely these poor forlorn ones have our deepest sympathy; but great as this fearful hecatomb has been, can it be compared to the annual (and I insist preventible) slaughter daily going on within our shores, with the thousands cut

down in our midst in the prime of life, by those now unresistless miasmas that unseen strike death into their victims ?

I wish some society would placard the walls of every town with the number of deaths that occur from unsanitary causes ; how quickly this would bring the authorities to their senses, who, perhaps, never even hear of the daily but isolated mortality occurring in their localities !

In the same way, and as an incentive to that action, that will be the means of saving both animal and fish life ; let every fishing society procure records of the number of dead salmon and trout found in their respective districts, and let the press proclaim that waters that can produce such results are impure and unfit for man or fish, and that when the means exist to render the filthy clean, the public should demand that what is feasible must no longer be delayed in being put into operation.

Can these questions be answered in the meantime ?—

Is the Thames polluted ? Ask those who live at Greenwich, Crossness, Deptford, Tilbury, and Barking ! Ask the great shipowners ! Ask the myriad craft that daily ply upon the river below London !

Is the Clyde polluted ? Is the Mersey ? Is the Irwell ? Is the Aire ? Is the Wye ? Can their impurity be denied ? What would old Izaak Walton say if he could witness the condition of the streams where once he was captivated by his fascinating sport ?

A meeting was summoned lately to discuss the polluted state of the Wye, which was till lately well known for its fisheries ; I therefore propose to read a short extract from the report of the meeting, taken from the *Field*.

“The meeting was largely attended by the influential

riparian owners of the neighbourhood and many other gentlemen.

"Mr. Millar, a fishery lessee, Newport, reported that there was no sign of the salmon disease in his district, in fact the fish were in excellent condition, not having been fed on Hereford grounds. (Laughter.)

"Sir Henry Scudamore Stanhope said that a gentleman who was fishing on his estate had told him that the water was so offensive that it took him a week to get his waders sweet again ;" and then Sir Henry made use of this very wise remark : that "water ought to be kept pure for the use of mankind." I only wish his desire could be accomplished more rapidly than it is likely to be.

A gentleman named Stephens then related "the experience of his workmen, who had seen hundreds of large trout and grayling dead in the river below Hereford, and they reported that the stench on the banks of the river was abominable." He also added a sentence that, I trust, the authorities of towns will take home to themselves ; he said, "If fish were killed in their natural element, the water was certainly not healthy for people and stock to drink."

A Mr. Lloyd said "they could not ignore the fact that the sewage of Hereford and other towns" (I will add, of every town allowing its sewage to flow untreated, or, what is even worse for the fish, badly treated by the use of lime, or badly worked sewage farms) "was doing immense injury to the river ; and he thought the time had arrived when the Board ought to tackle this great evil, or say that they were not prepared to do so ; or if they were, let them put the existing law in force."

Many other speakers bore testimony to the polluted state of the river, and the following resolution was passed : "That

in the opinion of the board the pollution caused by the sewage is most injurious to salmon and other fish in the River Wye, and the board requests the executive committee to take immediate steps to enforce the provisions of the Rivers' Pollution Act."

I have troubled you with these lengthy quotations from the above meeting as being the most recent press report that I have been able to trace of a polluted river, and of the effect of sewage upon fish life, although I am well aware that many other rivers have equal if not greater death rates among the inhabitants of their waters.

I shall be asked, I dare say, Why do you not tell us of the condition of the rivers upon which our larger towns are situated? The answer to this query is self-evident to every angler. In most of these, the glory of their names as salmon and trout producing rivers, have parted from them long ago, viz., when first the towns upon their banks grew to such an extent that these delicate fish could no longer withstand the volume of impurity that was entering their confines. I need not prolong the enumeration of rivers polluted more or less, and which must of necessity increase each day in the extent of their pollution as the population multiplies by leaps and bounds. Some rivers, no doubt, are only in the first stages of pollution, and others are, and have been for some time, in the most dangerous stage, and can be justly said to deserve to have the same words addressed to them as a poet has sung to one of the noble rivers of Scotland—

" My native Clyde, thy once romantic shore,  
Where Nature's face is banished and estranged,  
And heaven reflected in thy wave no more."

Now we come to the next proposition, which is not so

self-evident as the actual pollution of the rivers. It is this : "Is a river contaminated by sewage dangerous to fish life?"

The answer to this question should run thus: The extent and volume of the pollution must be taken into account. Take a parallel case. It is pretty generally known that lime water is inimical to fish life; a fish put into lime water dies immediately; but take a small quantity—say, two ounces of quicklime—and place it in a river well stocked with fish, and you will find no result from so small an amount; then gradually increase the dose, and you will arrive at the weight of quick lime that will kill all the fish in the nearest pool to where the quicklime has been put in. And so on, if you put a very large quantity into the river you would for miles kill all the fish it contained. I remember, some years ago, out of spite, a very large quantity was put into an Irish river, and for miles every fish was killed. Now apply this simile to sewage pollution: put a delicate fish into raw strong sewage, and he will very soon die; yet a small quantity of sewage allowed to run into a river has no effect, but the moment you pass the amount the fish can withstand they will become sickly and eventually die. From the meeting at Hereford you will have noticed that at distances remote from the actual source of contamination, no damage occurred to the fish in that part of the river, although below the sewage inlet. How is this? The solution of this difficulty may be thus explained: Rivers are supposed to have the power of cleansing themselves after their polluted waters have travelled a certain distance, although this inherent power is valuable only so far as the fish are concerned who inhabit the part of the river perhaps thirty miles below the source of pollution. Of course, this

never could be an excuse for the continuation of pollution by our towns, as the stench that is emitted during this self-cleansing process is very dangerous and offensive, and before self-purification is effected the distance travelled over is considerable.

The following interesting experiment has been lately made by Mr. J. W. Slater: He took three kinds of water; (1st) raw undiluted sewage obtained from Aylesbury; (2nd) similar sewage partially purified; and (3rd) sewage fully purified as it passes from the works of the Native Guano Company into one of the branches of the Thames. The sewage in question is strongly animalised, containing, in addition to the usual excrementitious matters and liquid household refuse, a somewhat unusual proportion of blood derived from the cattle slaughtered in Aylesbury for the London dead-meat market. Of each of these three kinds of water, the one half was filtered, and the other left in its original state. He had then six kinds of water. He then placed each portion in a white glass pint-bottle loosely stoppered, and arranged on a shelf exposed to the morning sun. In some of the bottles the stratum of water was  $1\frac{1}{2}$  inches in depth; in others 3, 4, and up to 6 inches. He now regularly examined the bottles, to take note of the changes that would take place. In the bottle containing the best purified water a green confervoid vegetation appeared in a couple of days; it increased, and bubbles of oxygen were formed and rose to the surface; there was no offensive odour. Similar phenomena were observed later in the other bottles; but eight weeks passed over before green vegetation appeared in the bottle containing 6 inches in depth of raw unfiltered sewage. In the meantime, the odour given off from this bottle had been very offensive, and a small quantity of white sewage fungus appeared,

which was gradually burnt up by the oxygen liberated by the green vegetation.

Mr. Slater then draws the following conclusions from his experiment. He says, the common belief seems to be correct that green vegetation unaccompanied by white fungoid growth is a favourable sign ; that sewage can purify itself, but that the process is very slow ; that the speed with which the impurities in a water are destroyed is greater when it is spread out in shallow layers to the action of air and light, and where its transparency is not interfered with by suspended matter. He, however attaches little practical importance to this property in sewage, the process being extremely offensive, and such treatment in practice would be ruinously costly.

No doubt the purification would be more rapid if the sewage was in motion in a river, and there found the water plants developed and ready to oxidize the impurities. In some cases the poisons from mining and manufacturing towns would hinder the development of any vegetation in rivers, into which these impurities were allowed to enter, and in these this means of self-purification would be entirely wanting, so far as it was produced by the plants they contained.

These experiments go to prove that all depends upon the extent and the quality of pollution ; and where you find a small river and a very large volume of sewage pouring into it, it will have nearly destroyed all vegetation, and one of the principal means of self-purification will only be developed sparingly. But even if it is admitted that self-purification is a fact, there seems to be now little doubt that in the actual neighbourhood of the sewage intake, the fish will in time succumb to an attack that, from our experience of the rapid increase of sewage, is daily becoming

more severe. I shall be asked here, How do you account for finding fish near the mouth of a sewer? I dare say they will be found at the mouth of a sewer with a small volume of sewage, but I should like to see them at the mouth of the main sewer from one of our large manufacturing towns. Perhaps they visit the sewer to pick up the particles of human food brought down by the sewer, or perhaps they are lazy fish, too idle to hunt for their food in a legitimate way, so come to the sewer to imbibe a kind of sewer tippie, instead of food, which sooner or later affects their health, and then they regret the over-indulged in excrementious stimulant, that has undermined their constitutions. But the end is the same, I presume, with these dipsomaniac fish, as it is with all the higher species—

“The ruling passion, be it what it will—  
The ruling passion conquers reason still.”

But I shall be asked, “How do you account for your assertion that fish cannot long exist in water containing large quantities of sewage?” It is a well-known fact that fish life is not supported by the oxygen existing in combination with hydrogen existing in the water itself. The oxygen they breathe is the free oxygen which has been dissolved in the water. Let a fish be placed in previously boiled water, in a stoppered bottle unagitated, and it will soon be found dead. This proves that they require this free oxygen for their existence. By analysis, it has been proved that in sewage-polluted water the quantity of oxygen is much reduced, when a comparison is made with an analysis of unpolluted water.

The oxygen, in fact, has been consumed in the changes it has undergone, which nothing but time or aëration by agita-

tion can replace. Thus I have little doubt that in two rivers equally polluted, the one a torrent and the other with sluggish waters, the fish would live much longer in the one than they would in the other. But the contrary might be the case with the human species, for any one would naturally be tempted by the sparkling water of the torrent, and if drunk before the dangerous properties had had time to become consumed, consequences little dreamed of would most probably be the result.

It is in the summer, and particularly if it should be an unusually hot one, that man and beast and fish life will suffer most from the pollution of our rivers. The water then is very low in our streams. At that period, therefore, less surface exists for the development of the chlorophyllaceous growths, one of the means of their self-purification. The same volume of sewage as in winter is mixed with a greatly diminished volume of water, and therefore the sewage pollution is stronger and more dangerous, also the smaller volume of water flows less rapidly, and consequently is not so thoroughly aerated ; and, besides, just at this time the ova of the fish are coming forth, and, like the young of every species, are less able to support an impure medium of existence. Without doubt they also suffer from the turbidity of the water intercepting the rays of light so necessary to their healthy growth.

Another question arises when the pollution of our rivers is considered : what effect has the flesh of fish, not only in a dying state, but even in a slightly sickly condition, upon any individual when consumed as an article of food ? We all know that the flesh of salmon, when out of season, is not only unpalatable, but dangerous if consumed in a large quantity : I remember a case where the eating of a portion of a spent fish caused vomiting, accompanied by diarrhœa.

Again, one can hardly imagine a more revolting meal than a salmon in the last stages of salmon disease. I should not like to touch one only slightly affected.

A fearful scourge of cholera is now devastating the upper part of Egypt, and it seems to have had its origin among that portion of the inhabitants who almost entirely subsist upon a fish diet.

A vivid picture of the waters from whence these fish are procured appeared a short time ago in one of the illustrated papers.

The waters appear to have borne upon their surface one vast mass of animal and human corruption. What must be the condition of fish who for weeks and months have been feeding on these festering abominations, and are even encouraged by the native fishermen to feed on them for the purpose of their capture? What a hotbed for the development of the worst kind of cholera—the impure waters—the fish caught for human sustenance bloated with their carrion food—and all around one reeking mass of decay! Why, surely around Damietta death must have ridden on every passing breeze. Is it not therefore more than likely that the suggested cause of this fearful epidemic is the true one—a daily diet of fish, fed on putrescent food dried in the sun, and many of these perhaps eaten before the sun had scorched out their liability to putrefaction, if, indeed, any amount of sun rays can render flesh from improperly fed fish suitable for human food?

Have you ever heard that fish caught near a sewer have an unpleasant flavour, and, if kept, will enter into a state of putrefaction much sooner than those taken further down? I am assured of this by competent authority, though I have not tried the experiment myself (I don't regret to say). If this is the case, is it not a most

potent argument with which anglers should support an agitation to insist upon our streams and waterways being brought back to that state of pristine purity, when they would be—

“Deep yet clear ; though gentle yet not dull,  
Strong without rage, without o’erflowing full ?”

Now to the remedies.

The town authorities thought they had made an excellent case when they only asserted, without contradiction, that there were no known means of purifying the sewage, and that consequently the pollution of rivers was a necessity, and, as a matter of course, the hackneyed proverb jingled on their tongues.

Science then stepped in, and she has put natural forces in action, that lay ready to do her bidding. First she suggested that mother earth should be called in as a purifier, and at once sewage farms began to spring up in various parts of the country, where it was possible to obtain land of a suitable quality (a very important consideration) for a sewage-farm. But many towns “rushed in where angels fear to tread,” and are now bitterly repenting their haste, in taking land entirely unsuited from its composition to thoroughly defecate the sewage. Others have taken land suitable in itself, but much too limited in extent, on account of the great cost of suburban property. Others are in this difficulty, that they cannot increase the area of their operations except at a ruinous cost. The great difficulty is in procuring land suitable for a sewage farm. You must have land that would be called a dry friable clay soil ; this means generally that it is high-lying, valuable for agricultural purposes, and therefore expen-

sive to buy ; and even if you can buy it, you cannot, in most cases, buy enough to satisfy the wants of an increasing population. I have said it should be dry land, and therefore generally lying at a higher level than the town, that means expensive pumping to get the sewage on to the land. The limited state of most sewage-farms obliges the managers to put sewage upon the land when it requires neither irrigation nor stimulation.

What is the result? The most successful sewage-farm is obliged to grow hardly any other crop than that gross feeder, Italian rye-grass, and it generally resembles a snipe-marsh more than it does a high-class farm.

I will not even enter on the question whether or no the same plot of land can stand for long a monotonous diet, my private opinion being that what will kill the human being is unsuitable to land. I mean the same food every day. I believe I am correct in stating that it would require the whole county of Kent to treat the sewage of London in such a way that crops more remunerative than rye-grass could be successfully produced. And what then would Maidstone, Ramsgate, Margate, and Canterbury, and other growing places do if London took up their available sewage-farm ground? if, indeed, it exists near them of a suitable description. Besides all this, I assert that there is not an existing sewage-farm of any fairly large town that is not at times a dangerous nuisance, for the reason that to be otherwise they should be at least four times as large. Let us take London again as an instance of what is to be done to produce a solution of this difficulty: can anyone assert that a sewage farm is practicable for the Metropolis? It is utterly impossible. As another alternative, we are threatened with an expenditure of two millions of money to

carry out what would be disastrous policy—a policy of robbing Peter to pay Paul, by discharging the Metropolitan sewer lower down the Thames estuary. But will the Peters of Ramsgate and Margate, and the hundreds of rising sea resorts fringing the lower Thames and the coast on each side of its mouth, submit to have their salubrity sacrificed to enable London—who ought to be the sanitary guiding star for the empire—to commit a grievous wrong to its neighbours? Will she be permitted again to build up miles of a black wall of pollution in the Thames, whose Styx-like waters are now daily ploughed up by our countless fleets of shipping, or perhaps, still worse, they are obliged to anchor on its fever-breathing waters. Is it possible for fish to force their way through this wall of impurity? No! I have little doubt than when a salmon, more enterprising than his fellows, forces his way even a mile into this filthy barrier, he turns back in disgust, fully convinced that the river, once the home of his ancestors, has ceased, from source to mouth, to be a fit habitation for his species. But if neither irrigation nor a second *Cloaca maxima*, with its daily outpouring of that which in its proper form is a mine of agricultural wealth, can solve the Thames difficulty, how is it then to be overcome?

At this stage I will explain to you a combination of chemistry and one of the powers of Mother Earth. The intelligent experiments of Mr. Sillar ended in a patent being taken out, which is now being worked by the Native Guano Company. This marvellous system, only lately prominently brought before the notice of the general public, is being worked within the confines of this Exhibition—No. 798 in the official catalogue—in a special annexe, where the process is demonstrated in active operation. And why,

pray, is this a solution of the difficulty? I invite all those interested to go and judge for themselves—

- 1.—Because it can be carried on without the slightest nuisance in all its stages.
- 2.—Because it absolutely complies with all the provisions of the Rivers Pollution Act.
- 3.—Because it can be adapted to a single institution, or to this vast metropolis.
- 4.—It is always manageable, and it is easy to detect if its functions are in proper working.
- 5.—After sending the foul water by its action back pure and limpid into the stream, it retains for the use of the now much hampered agriculturist all those valuable properties of the sewage, not indeed only applicable within the selfish confines of the sewage-farm, but in such a portable form that those near or far from the source of supply are on practically equal terms ; and now
- 6, and lastly.—It produces an effluent in no way dangerous to fish life ; as can be seen here in this Exhibition, where fish of all kinds are exhibited, living in the effluent from the foulest sewage, after it has undergone the magic effect of the A B C process.

Gentlemen, I have now shown you, to the best of my ability, both the sanitary and the piscatorial aspects of river pollution, it being nearly impossible to separate them in discussing this (now so generally called), the question of the day. The remedy I have suggested all can see, and seeing is believing ; and if they agree with me that it is one easily

applied, let them join with us in saying to the river polluters : "so far you shall go, but no farther," we insist upon your taking action, you, having got a remedy easily applied, and just as easily deserted if from any cause it should fail or a better come to light, and, by its adoption, you can never be hampered with unprofitable farming land, purchased at enormous cost.

I thank you all for the kind attention you have given me ; many of you I recognise as old strugglers in the sanitary battle ; but there are some who have heard me here to-day, who have, perhaps, only just placed their feet on the first rung of the ladder of sanitary reform ; let them push on with us, and become "the life-blood of an enterprise," not caring for particular processes, or becoming great respecters of persons, but determined that where pollution reigned once, no matter who is responsible, its name shall be known no more ; be it pollution of that element essential to the lives of animals and fishes, or that more essential to the human being. A small black cloud, no larger than a man's hand, is visible on the distant horizon ! If some unpropitious breeze should bring it nearer, and it should burst upon or near our shores !—I will ask you this solemn question, Are we prepared to meet it ? Have we no skeletons in the sanitary cupboard of this country ? Have we not hotbeds ready, not perhaps to give birth to, but at any rate to foster and multiply the germs of that terrible disease that is now striking terror and panic into many a land ?

A horrible responsibility rests on the shoulders of us all. We, the public, who should cry out for those Augean stables to be swept ; and the authorities in power, who should be up and doing. Even, if necessary, a more powerful Act of Parliament should be passed—it was procured for our

protection from the ravages of dynamite—but I say a greater than Dynamite is here, capable of slaying his tens of thousands. The dying fish tell an unmistakable tale. They are the straws that point the direction to which the sanitary stream is flowing. Our hearts should leap to action when we think of what will be our reward! Not that of silver and gold, but the far higher one of having been the means of saving countless lives, which otherwise would have been sacrificed to a preventible cause—a want of sanitary reform.

Don't let us delay, then! Let us imagine we hear the Poet Laureate's beautiful words, warning us—

“ . . . They die in yon rich sky,  
They faint on hill, on field, or river ;  
Our echoes roll from soul to soul,  
And grow for ever and for ever.  
Blow, bugle blow, set the wild echoes flying,  
And answer, echoes answer—dying, dying, dying.”

## DISCUSSION.

The Rev. J. MCALISTER said there were three questions brought prominently forward in this paper ; first, as to the supply of food ; secondly, whether the health of the people living on the banks of rivers into which sewage was allowed to flow was affected by it, and lastly and most important of all, could these evils be remedied? Firstly, there could be no doubt the fish was provided by Providence in our rivers, and was there ready for capture, provided we did not interfere with them by the introduction of sewage and other poisonous matter. As to their being injured by sewage there could also be no doubt. He had been a witness before the Royal Commis-

sion on this subject and claimed some little credit for having assisted in obtaining the appointment of the Royal Commission. Having given his own evidence he waited a short time to hear the evidence of the next witness ; he was a professional fisherman, and in answer to questions, he said he had not for a long time fished in the Thames above Gravesend, but in former times he used to fish up to Battersea Bridge ; he did not do so now because he could not find any fish. That was conclusive evidence as to the effect of sewage in the river, and he apprehended it was the experience of every one who knew anything about fishing that where sewage was introduced in any quantity it would seriously interfere with the growth and production of fish. On the second question, that which affected the health, he had stated in evidence that he could smell the noxious vapours which arose from the river at a distance of three miles ; and that he could distinguish it as clearly from other smells, such as those which arose from a manure manufactory in the neighbourhood, as he could distinguish the smell of a boiled onion from that of a boiled potato. He had observed for the last twenty years that when the wind blew from the north-east, the direction of Crossness towards Plumstead and Woolwich, the health of the inhabitants gradually fell, and when it changed their health improved. This had become quite a byword amongst the people. At certain seasons, partly in March and October, when the north-east wind blew, there were certain states of health generally manifested, not exactly sickness of any decided kind, but the whole life seemed to be below par—a loss of appetite and lassitude ; and when they went to a doctor he almost invariably gave them quinine. But as soon as the wind changed to the south or west, all this was corrected. He did not suppose there

was a man in the country who enjoyed better health than himself, but he always felt the same thing when the wind blew in that direction—that he wanted a trip to Brighton or something to set him up. Now as to the possibility of remedy. He should like some one to answer the question whether any municipality, or any man, or body of men had the right to pour this sewage into a river and poison the inhabitants on its banks? The answer would probably be—We cannot help it; it is a matter of necessity. If it were, he would say no more. Necessity had no law; but was it a necessity? He had taken the pains to investigate the process of the Native Guano Company, and had to thank Mr. Sillar and his subordinates for their courtesy in explaining the system to him and some of his neighbours from the vestry of Plumstead, who went to Aylesbury to examine it. He was convinced from what he saw that the company were able to do all that was required. It was competent to take the whole of the sewage of London, which was now poured into the river at Crossness and convert it into useful manure. He had no interest in the matter beyond a wish to improve the circumstances of his parishioners and neighbours. He had tried the manure on some of his own land, which was very poor, and found it most excellent; he had used it for potatoes, carrots, parsnips and onions, and it produced crops such as he had never seen equalled. In conclusion he gave it as his opinion that an Act of Parliament should be passed rendering it penal for anyone to put sewage into a river.

Mr. WASHINGTON LYON said he also had had the pleasure of going to Aylesbury to see the process in operation, and he drew the conclusion that sewage ought not to be allowed to go into any river in the kingdom. Everyone agreed as to the mischief it did; it was not worth discussing

that question, but he wished the paper had given a few more definite facts. The Corporation of London had appointed a committee to consider this question, and they were now fighting the Metropolitan Board about it. They had not yet found a remedy, but they agreed it ought not to go in. He had seen the water running into the river at Aylesbury perfectly pure after the solids were taken from it, but the question was at what expense it was done. He was of opinion that no corporation ought to look for a profit in getting rid of its sewage ; they got no profit from sweeping the streets or clearing the dustbins. It was not a question of profit, but of getting rid of a nuisance ; and people were prepared to pay any reasonable sum, but they must not pay too dear for their whistle. Only last Friday he went down the river with some other gentlemen to see the state of it, and for miles below Crossness it was polluted by the sewage. It cost a large sum of money to send it into the river, and this, of course, ought to be deducted from the cost of this process, which yielded, he understood, a manure which was worth £3 a ton.

Mr. SMITH thought there was a little omission on the part of the reader of the paper in not referring to the important duties of the Thames Conservancy. They had instituted proceedings, and fined various people for putting sewage into the Thames above London, and it would be a great anomaly if the Metropolitan Board were allowed to discharge sewage into it whilst the people at Paddington, Richmond, Windsor, Oxford, and other towns up the river, were being bound to carry out expensive works to prevent it. The question had been asked, whether any municipality had the right to put sewage into a river. He thought it would be admitted that when the drainage from the Metropolis was under consideration, the Metropolitan Board

of Works took the best possible precautions, and went to great expense in getting the best possible engineering skill to design sewerage works at the time chemical processes were not brought to such a state of perfection as they now were. He had also been to the works at Aylesbury on two occasions, and considered they were model works.

Mr. MILNE HOME said most of the speakers had referred to the state of the Thames and to the effect of sewage on fish, but this was a very large question, applicable not merely to the Thames and rivers in England, but to those of every part of the United Kingdom. He came from Scotland, where many of the rivers had suffered in exactly the same way as the Thames, and effects had been produced not merely on the fish, but also on the health of the inhabitants on the banks. A great deal had been said about this subject, and though it did not come under the title of the paper, they had an intimate connection with one another. He remembered when reading the report of a sanitary commission some time ago they asked M. Dumas, the chemist, what was the simplest practicable method of ascertaining the purity of water as fit for human beings and animals to drink, and his answer was that it was not necessary to have any chemical test, but if they put a young fish into the river and it did not live it was a complete proof that the water was not fit for the use of man. It was fortunate that various remedies were known, but the one chiefly spoken of to-day was of a chemical character. Allusion had also been made to the possibility of rectifying sewage and refuse of manufactories by means of irrigation. He had various experience of the mode, and had had the misfortune to be in two actions of law connected with sewage. After studying various remedies he was in favour of chemical appliances rather

than any other, for this reason, that however much land you might take for the purpose of spreading liquid manure on the surface to produce crops, in the course of time the land would become so saturated that it was necessary to obtain an additional quantity, which was very expensive. He had not seen the works at Aylesbury, but had read about them, and his son, who had property in Berwickshire, told him that he had visited them, and had tried some of the manure on a small home farm which he had, and found most excellent results from it. He understood the rev. gentleman who spoke first suggested that the laws ought to be of a much more penal character, and he was quite of that opinion himself. He thought it was a criminal act on the part of people to poison those rivers which were intended by Providence for a totally different purpose. In Scotland they had Public Health Acts, some of which contained provisions especially applicable to boroughs and populous places—a populous place being defined as a district occupied by a population of 1200. Under these Acts it was a criminal offence to put any noxious matter into a stream running through such a district, and the offender could be not only fined but imprisoned. That law ought to be adopted for the whole of the kingdom, not only in boroughs and populous places, but everywhere. He lived in the district of a river which traversed three or four counties, and persons on the banks were more or less deprived of the use of it. They could not avail themselves of it for any domestic purpose. This subject, although connected with fish, was also connected with the health and happiness of the whole population. The great difficulty was, who were the persons to enforce the law? He was a riparian proprietor, and hitherto it had been left to individual proprietors to endeavour to stop the

pollution of rivers. There had been many cases in the Courts of Session where individuals had come forward at considerable expense, and incurred considerable odium, to stop this pollution, and it ought not to be left in their hands. It was a matter which affected the national interests, and it was the duty of the Executive to appoint public officers to see that this evil was not committed. He trusted that some expression to that effect would go forth from the Conference.

Mr. SURR said this was a subject which came home to them all as individuals and members of a large community living on the side of the large rivers. Being born in London he remembered being taken out as a boy in wherries on the Thames, and the river was then pure between Poplar and Blackwall, where whitebait were found in great quantities, but they were not now to be found below Thames Haven and Southend. He would not go back to the old times when it used to be stipulated by the parents of apprentices that they should not have to eat salmon more than two or three times a week, but he must say that the Thames was now a disgrace to any city, and was gradually becoming worse. He was down the river on Friday, and in many parts there was a most noxious effluvium. Why was the sewage of a city to be continually sent into a river to do so much harm when it might be utilised for the benefit of the country at large? Not only had the Metropolitan Board spent an enormous sum to do a great amount of mischief, but they were going to increase the sum to carry the sewage lower down. He had no personal interest in the A B C Sewage Company, but had had an opportunity of examining the works, and had seen sewage from Aylesbury flowing through a succession of tanks until in the last tank there were fish swimming about in perfectly pure water. He had also seen

very fine specimens of vegetables which had been grown with the aid of manure prepared there, and trusted the process would have a fair trial.

Mr. WEBB, who regretted that he had not been in time to hear the paper, spoke at considerable detail of the advantages which he had derived from the use of the manure manufactured by the Aylesbury Company on all kinds of garden produce.

Mr. CHARLES E. FRYER thought every one was pretty well agreed that the river was not the proper place for sewage to be put. Various witnesses had been brought forward in support of the view ; there had been some giant potatoes, and enormous turnips, and miraculous cabbages, and other vegetables, but he would venture for a moment to bring forward another witness from the animal world, a fish, and the testimony he referred to was taken from the following extract from the *Times* :—

“An interesting capture was made a few days ago off Erith, that is fourteen miles below London-bridge. A sturgeon, floating almost lifeless down the river, was noticed by some of the men belonging to Messrs. Callender's Bitumen and Telegraph Company. When dragged to shore, it had sufficient life in it to spout water out at its captors, but appeared to be nearly suffocated, a fact attributed to the sewage which is turned into the Thames at Crossness, about a mile from the works. It is nearly as large as that lately presented to Mr. Parnell, weighing 117lb., and is in length 6ft. 3in. It has been two days on view at the Fisheries Exhibition, but has been removed for a short time for the purpose of stuffing, after which Mr. Callender has kindly consented to restore it to the Exhibition.”

He thought the fish must have come up the river on

purpose to die on behalf of the people of London. Like a noble martyr it had laid down its life for the benefit of those who would have caught it alive and in health if they could. It had been said that before proper means were taken to prevent railway collisions, a bishop must be killed, but in this case they came very near Royalty being killed, for the sturgeon was a Royal fish; and, therefore, now there was a Royal witness in favour of moving sewage from the Thames, it was high time for everyone else to follow such an Imperial personage, and to insist on the filth being taken out of the noble river, and not only out of the Thames, but out of every other river into which sewage and other pollutions were allowed to flow. 10,000 square miles in England alone out of 60,000 were utterly destroyed, as fish-bearing rivers, by pollutions of this kind. It was essential that this should be prevented for the sake of the many interests which have been referred to. As to that question of cost, it was not a mere matter of *£ s. d.* how much it would cost to do this, or how much to do that; the enormous advantage to the health of the populations adjoining must be taken into account, besides the gains the community would derive from having fisheries restored which at present were destroyed, and the enormous advantage of having valuable manure, which, if put on the land, would produce enormous crops instead of being put into the river where it dealt death and desolation wherever it went. As to this particular company he had not the slightest interest in it, but he had watched its career with great interest and examined the works when first established at Leamington. Comparing the nuisance, as it was called, of the slight effluvium he occasionally perceived in the early days, it was nothing in comparison to the stench which arose from the irrigation farm which had replaced it. If,

therefore, it was possible to turn sewage into profitable manure, as it had been proved, the 5 or 6 million people in London ought to put their heads together and put their feet down and say they would insist on having the sewage taken out of the river. It was no use for it to be taken out at Crossness, and carried half a dozen miles lower down, nor, as some enthusiastic engineer suggested, that it should be taken 20 or 30 miles out into the German Ocean, where it would not be the slightest good, and would be an injury to those fisheries which the Exhibition had been promoted to foster.

Mr. SILLAR said he should not have said anything on this occasion as what he could have said had been much better said by perfectly unprejudiced and impartial witnesses, but as Mr. Lyon had asked for a few facts he thought it right to say a few words. This process had been in active operation at Aylesbury for some eight years. During those years the water had been so cleansed as to meet every requirement of the riparian owners, and to receive annually a vote of perfect confidence by the trustees of the town ; secondly, the works had been visited constantly, sometimes every day, and even at night, by the officials of the town, who bore unanimous testimony to the fact that there never was the slightest nuisance of the kind ; thirdly, with regard to the value of the manure, the effect of the severe test, the market price, applied to it was very satisfactory, for the demand was greater than the supply.

The CHAIRMAN then said he should submit the following resolution which he thought would be a very suitable outcome of the discussion : “ That it is the opinion of this conference that the pollution of rivers is an evil so serious that stringent measures should be adopted without delay,

both by Imperial and local authorities, to enforce already existing Acts, and, if necessary, to amend them." It had been suggested that there should be additional legislation, but he thought there had been too much already, and too little application of it; one gentleman asked the question how it was their municipalities had power to put sewage into the rivers. It had been by the powers of legislation. He had been engaged in sanitary matters for more than 30 years, and had visited various sewage works, and a considerable time ago formed his own opinion, which was confirmed by the steps the Thames Valley Board had taken, that the only way of dealing successfully with it was by chemical treatment. The three points obtained by the Aylesbury Company were an innocuous process, a pure effluent, and the disposition of the process. Those were the three important points to be ascertained in all sewage works. At the time of the first outbreak of cholera all the learned men and medical authorities cried out there was death in the cesspool, and legislation followed, compelling all the towns within ten or fifteen miles of London to close up their cesspools, and they were all compelled to carry out a system of drainage conveying the sewage into the Thames. This was done under the heavy penalty that if the local authority did not carry out the works, the central authority had power to come and do it for them at an enormous cost. That was done at Kingston-on-Thames at very great cost, and so matters went on, all the towns pouring their sewage into the Thames, until the next outbreak came, and then it was said that death was in the rivers, and then came legislation to compel those towns to remove from the river the sewage which they had been compelled to pour into it, and they had ever since been trying in the most thorough *bona fides*,

had spent considerable sums of money, and on two or three occasions had bought the land to endeavour to get rid of the sewage. Finally they had a vast inquiry, which lasted over five days, into the question of the Thames valley sewage, and cost 20,000*l.* or 30,000*l.* This inquiry ended in nothing. It simply condemned the systems then proposed of dealing with the sewage of the Thames Valley by ordinary irrigation. He was glad to say that that very Board of twenty-four members had now unanimously determined that the only way of dealing with it was by chemical treatment, and at this moment two eminent engineers were appointed for preparing a scheme or schemes for dealing, on this plan, with the sewage in one or more places in the Thames valley, and this was the nearest approach he had yet seen to a solution of the difficulty. The delay which had taken place was not due to the local authorities, but to the Local Government Board, to whom was entrusted the supervision of these works. Their idea was total diversion, and they had sought to force that upon the local authorities against their convictions, endeavouring to compel them to carry away the sewage by what was called the West Kent sewer, and throw it into the Thames. The only effect would be to involve hereafter an additional cost in carrying farther the same defective appliances. They did not want additional legislation, for the local authorities were perfectly ready to do what they could. They had spent money in a liberal way in endeavouring to solve the difficulty, and he did hope they would now get a solution in the direction he had named. He was quite certain that the Aylesbury Company had done more at Coventry to demonstrate the evil of this method of dealing with the sewage than anyone else ; and although there seemed to be a prejudice against these works, he

believed that every month that prejudice was passing away, and that this method or some similar one would be adopted in the Thames valley. On one occasion he went with a deputation to the Local Government Board, saying they were prepared to carry out works to the satisfaction of the Board, and complete them within one year from the date for adopting this process, but the scheme was refused. It was a singular thing that out of the many towns on the Thames valley to which reference had been made, and which had propounded schemes and submitted them to the Board, all had been rejected but one. The only scheme which the Board consented to was that for Richmond, and when the local authorities attempted to carry it out it was found absolutely impracticable.

Mr. C. H. CRESSWELL had great pleasure in supporting the resolution. He believed it to be an eminently practicable one, and entirely agreed with the decisions arrived at by the Public Health Conference held by the Society of Arts two or three years ago. The great evil which existed at the present time was the apathy on all sides, both of the Government and the people. It was not necessary there to discuss the question, whether rivers ought to be polluted or not, or whether people had any right to pollute them, though the question had been asked, and before sitting down he would take the liberty of answering it. Nor was it necessary to discuss the propositions whether fish could live in polluted water, or whether fish was of any consequence to the food of the people, or whether river water was rendered unwholesome for human purposes by contamination. Those were all matters which were admitted in every civilised society. If they were to go to Yorkshire, and walk along the banks of some of those famous streams, or by the Clyde

or the one to which Mr. Milne Home referred, it would be quite easy to discuss the point whether fish could live in them—some were black, some were red, and some were blue, and he believed some were green; it entirely depended on the particular dye which happened to be in vogue at the time, and the emphatic answer which was once given to him by an old woman was conclusive whether the pollution was injurious or not. He asked her whether she could use the water in the river for the ordinary purposes of washing, and she said she only used it when she wanted to dye her clothes. In that sense no doubt the rivers were valuable, but they were not intended for any such purpose. What was wanted in order to cope with this great evil was the support of public opinion; they had plenty of legislation, and the resolution emphatically expressed the invariable opinion of all scientific men who had brought their minds to bear on this subject during the last 30 years. There was already an Act which rendered the contamination of rivers penal, but some independent authority was required, not the criminal himself, as was too often the case, to enforce the Act which already existed, and at the back of that a thoroughly earnest Government determined to enforce the law. The difficulty was just this, the reverend gentleman asked whether there was any right to pollute rivers. Up to the year 1876 there was such a right. He had told them that in certain districts in the neighbourhood of London not only had they a right, but they were actually compelled to pollute them. It was considered the rivers were given by God for the express purpose of carrying away down to the sea the filth and refuse of the human race, where it could be swallowed up and annihilated. In certain rivers in England the manufacturing population had for centuries claimed the exclusive right to pollute the rivers, and

if a miller or a dyer, or fuller, or any other manufacturer were charged with the offence of polluting the stream to the prejudice of his unfortunate neighbours, the answer always was that they enjoyed the special privilege for twenty years, and therefore had a prescriptive right to foul the river and could not be interfered with. He recollected a celebrated man, who afterwards became a member of Parliament for a Borough in Yorkshire, who was charged by the Royal Commissioners twenty-five years ago with contributing more largely than anyone else to the pollution of the stream which flowed through the town of which he was a distinguished member. He said he was quite willing to do everything he could to put a stop to the pollution, but he and his firm had enjoyed the privilege for sixty years, and he was not going to give way. When men argued in that way the great want was more healthy public opinion in order to get over that which was the most deadening and difficult of all obstacles, namely, apathy combined with ignorance. These prescriptive rights which were exercised all over the country, and especially on the Irwell, brought about pestilence which was commonly considered an evil; but, in his opinion, pestilence, which came down from Heaven at various times, had been the greatest Divine benefit which could ever have been conferred on the people. The cholera did more good to England than anything which ever happened, for they all knew that it was after the cholera outbreak in 1847 and 1848 that there were passed in this country the first measures for the public health, which had gone on steadily improving and increasing since. The prescriptive pollution had risen to such a pitch that no water could be had for any purpose whatever, and then what was called the Rivers Pollution Act, 1866, was passed, and effectually put a stop to all the nuisance about prescrip-

tive pollution, and, for the first time in the history of the country, made it a misdemeanour to pollute a river either at the source or any part of the stream where it passed through a populous district, wherever there were any riparian proprietors prepared to enforce the law. The mischief of the Act was that there was no one to put it in force. It was a beautiful piece of logic, but in many cases where an attempt had been made to enforce it they found their hands were tied, and they were perfectly powerless. It was rather a prolix question to explain, but he would endeavour to do so shortly. In the first place the persons charged with the enforcement of the Act were generally the greatest offenders against it, viz., the local authorities. If you went to the local authorities and asked them to stop a particular firm polluting the stream they would say : Yes, we will do what you want, but inasmuch as the local authority was polluting the stream with sewage, they were naturally nervous about commencing proceedings, and thought it better not to stir up muddy water, and so in the end nothing was done. Then the Act gave power to an individual to go under those circumstances to the Local Government Board and ask them to assist. That had been tried, but there was so much red tape and circumlocution that the libraries and registries of the office were papered with documents, in which they threatened, exhorted, encouraged, and so on, but it really ended in nothing. He believed there was only one city in England where any attempt was made to put the Act in force, and there it failed because the local authority would not take the steps. Perhaps the Local Government Board did not think it worth while to offend the town, and the end was that nothing whatever

was done, and the unfortunate riparian proprietors whose fish were killed for miles below Hereford, were told by the local lawyers that they must put the Rivers Pollution Act in force themselves ; they accordingly filed a plaint in the County Court against the town, and the result was, the town was convicted and a serious penalty imposed. Mercy intervened, as it always did, and an opportunity of repentance was given to the city, which was allowed a certain time during which it might kill all the fish in the river, and at the same time take the measures it ought to have taken 10 years ago. Perhaps in 6 months' time a renewed action would take place. That was a case within his own knowledge in 20 or 30 important cities in England. He believed the reading of this paper and this resolution as the unanimous expression of opinion of such a meeting would do something towards the formation of a wholesome public opinion, and unless public opinion was as wholesome as the water ought to be, nothing valuable would ever be effected. If any epidemic were to break out the public would move in greater alacrity, and he had been much struck with the conclusion of his friend's paper in which he alluded to a little black cloud on the horizon and gave an emphatic warning to the public. He saw by the evening paper, that the cholera, instead of diminishing, was spreading rapidly in the East, so as to give occasion for the greatest misgivings. It seemed a terrible thing to look forward with any degree of pleasure to such a calamity, but still he thought it was quite right to use an expression which had become proverbial, and was often supposed to be Scriptural, thought it was not, viz. : that God tempered the wind to the shorn lamb, and if they did have an epidemic he was perfectly certain that would be a magni-

ficient demonstration of the grand doctrine that all things worked together for good, and that good would come out of evil.

(The resolution was then put from the chair, and carried unanimously.)

Mr. SYKES moved a vote of thanks to the Hon. Mr. Mainwaring for his paper.

The Rev. J. MCALISTER seconded it, and asked leave to include in it a vote of thanks to the Chairman.

The resolution having been carried unanimously,

The Hon. Mr. MAINWARING said he was extremely gratified at the result which his paper had produced, especially as it had elicited such a practical discussion, which he had little dreamed of. Everyone seemed to agree in the views he had expressed, and he hoped that now the public would not go to sleep and sit twisting their thumbs, which was very much the fault of Englishmen; they were too apt to say what a dreadful thing it was, but they did not do anything unless some body of energetic men took action. He found everywhere that it was by a small amount of leaven that the whole lump was put in agitation. He hoped the paper and discussion would have some practical outcome, and would have a far greater effect through the medium of the press. The press was all powerful in these matters, and he wished it would put before the public more fully the condition in which we were at this moment in regard to river pollution. If the press would move, the public would follow, and if they would only take the matter up, the desired end would be attained much quicker than otherwise could be hoped for.

The CHAIRMAN also briefly responded to the resolution, saying how pleased he was at the result of the meeting; and the Conference then adjourned.

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